

CLAIMS

What is claimed is:

- 1 1. A ball grid array device comprising:
2 a substrate, further including:
3 a first major surface; and
4 a second major surface; and
5 an array of pads made of an electrically conductive material, the array of
6 pads positioned on the first major surface, at least one of the array of pads including
7 a diffusion retarding layer to retard the rate of diffusion of the electrically
8 conductive material from the pad.
- 1 2. The ball grid array device of claim 1 further comprising a binding layer
2 for binding the diffusion retarding layer to the conductive material of the at least one
3 pad.
- 1 3. The ball grid array device of claim 2 further comprising a layer of
2 material for receiving solder.
- 1 4. The ball grid array device of claim 2 further comprising a layer of
2 material for receiving solder placed on the diffusion retarding layer.
- 1 5. The ball grid array device of claim 1 wherein the electrically conductive
2 of the pad includes copper.
- 1 6. The ball grid array device of claim 1 wherein the diffusion retarding layer
2 includes Kovar®.
- 1 7. The ball grid array device of claim 1 wherein the diffusion retarding layer
2 includes 54Fe-29Ni-17Co.

1 8. The ball grid array device of claim 2 wherein the binding layer includes
2 Titanium (Ti).

1 9. The ball grid array device of claim 2 wherein the binding layer is
2 Titanium (Ti).

1 10. The ball grid array device of claim 9 wherein the Titanium binding layer
2 has a thickness in the range of 80 nanometers (nm) to 120 nanometers (nm).

1 11. The ball grid array device of claim 9 wherein the Titanium binding layer
2 has a thickness in the range of 90 nanometers (nm) to 110 nanometers (nm).

1 12. The ball grid array device of claim 4 wherein the layer of material for
2 receiving solder includes gold (Au).

1 13. The ball grid array device of claim 4 wherein the layer of material for
2 receiving solder is gold (Au).

1 14. A substrate comprising:
2 at least one pad of a copper material;
3 a diffusion retarding layer placed over the at least one pad; and
4 a layer of gold over the at least one pad diffusion retarding layer.

1 15. The substrate of claim 14 wherein the diffusion retarding layer
2 includes 54Fe-29Ni-17Co.

1 16. The substrate of claim 14 further comprising a layer of titanium (Ti)
2 used to bond the diffusion retarding layer to the material of the at least one pad.

1 17. The substrate of claim 14 wherein the diffusion retarding layer

2 includes 54Fe-29Ni-17Co, the substrate further comprising a layer of titanium (Ti)
3 used to bond the diffusion retarding layer to the material of the at least one pad.

1 18. The substrate of claim 14 further comprising a plurality of pads.

1 19. The substrate of claim 14 further comprising a plurality of pads arranged
2 in an array.

1 20. A method for forming a pad on an electronic device comprising:
2 forming a copper pad on the electronic device; and
3 placing a layer of material to retard diffusion of the copper over the copper
4 pad.

1 21. The method of claim 20 wherein placing a layer of material to retard
2 diffusion of the copper into the solder ball further comprises adding a layer of
3 material to bind the layer of material to retard diffusion of the copper.

1 22. The method of claim 21 further comprising placing a layer of a material
2 to enhance the solderability of the pad onto the layer of material to retard diffusion.

1 23. The method of claim 20 further comprising:
2 binding the pad and the layer of material to retard diffusion with a binding
3 material; and
4 adding a solderable layer of material onto the pad to enhance the
5 solderability of the pad.

1 24. A method for forming a bump on a ball grid array device comprising:
2 -forming a copper pad on a substrate;
3 placing a layer of material to retard diffusion of the copper over the copper
4 pad;
5 placing lead free solder on the copper pad; and

6 heating the ball grid array device to heat the lead free solder to a liquid state
7 so that the surface tension of the lead free solder forms a ball; and
8 cooling the ball grid array device.

1 25. The method of claim 24 further comprising binding the diffusion
2 retarding layer to the copper pad.

1 26. The method of claim 25 wherein binding the diffusion retarding layer to
2 the copper pad includes placing a binding layer of titanium (Ti) on the copper pad.

1 27. The method of claim 24 further comprising placing a layer of gold on
2 the diffusion retarding layer to enhance the ability of the pad to receive solder.

1 28. A ball grid array device comprising:
2 a substrate including a first major surface, the substrate further including an
3 array of pads made of an electrically conductive material, the array of pads
4 positioned on the first major surface; and
5 solder placed on at least one of the array of pads, the solder and the pad
6 including an intermetallic compound including Ni-Sn (Ni_3Sn_4) and Sn-Fe.

1 29. The ball grid array device of claim 28 wherein the solder is lead-free.

1 30. The ball grid array device of claim 28 wherein the pad includes a
2 layer of gold.